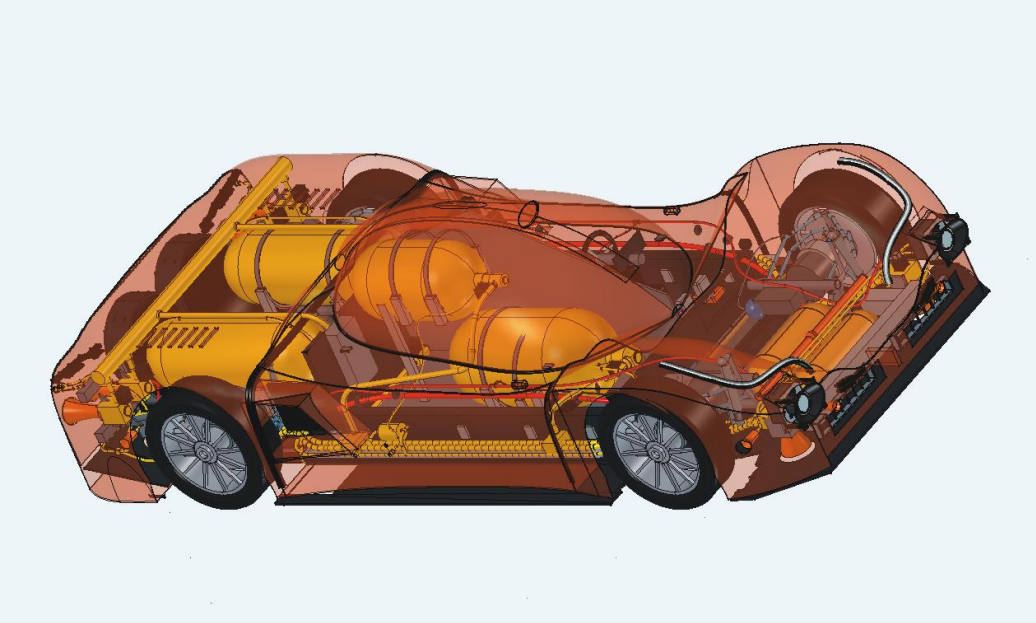
IMPULSE R06 / TS 01 / for owner decision

Technical specification and implementation options

Ground demonstrator and short-hop research



IMPULSE R06 presentation CAD model. The exterior is the reference for all three options.

Recommended option V1 pairs a ground electric AWD vehicle with an independent RWD-geometry rig. R06 free flight remains on HOLD. G0 requires an owner decision on mission, budget and scope.

Prepared for the programme owner and expert committee. Basis: expert replies dated 23 November 2026, questionnaire R02 and the R06 stock calculations. R06.1 denotes the planned next CAD revision.

Specification issue 1.0 · 23 November 2026 · TextToCAD

Contents

Pp. 2–5 Options V1–V3 and selection conditions
Pp. 6–9 R06 baseline, +20% rule and open decisions
Pp. 10–13 G0–G5 milestones, deliverables and cost
Pp. 14–15 Targets T01–T18
Pp. 16–33 All 61 requirements, acceptance criteria and owners
P. 34 Source records and decision form

Architecture and scope

Choosing a programme option

The owner selects one first delivery, its operator and scoring discipline. Retain the IMPULSE exterior, specify the loading condition and maintain separate AWD and RWD records. Each configuration receives its own performance record.

Option	Operator delivery	Selection condition
V1 · AWD plus RWD rig	Track AWD without onboard high-pressure vessels. A separate rig for landing research.	A working ground vehicle is required while B09 remains open. Gas research has its own investment decision.
V2 · RWD sprinter	Lightweight straight-line RWD with electric drive, suction downforce and horizontal gas thrust.	The owner prioritises acceleration and accepts separate qualification of the onboard gas system.
V3 · electric track car	A gas-free car for lap performance, cornering and repeated braking.	The owner prioritises repeatability and closes flight research. Mass and suspension mount verification still apply.

The expert recommendation for G0 is V1. If B09 fails at G2, F08 closes flight research and the ground AWD follows its own release route. Moving to V2 requires a new owner decision. V3 may be selected at the outset.

Architecture and scope

Option 1 Ground AWD and a separate RWD rig

Track operator delivery

Develop electric AWD with fan downforce, friction braking, HV protection and independent timing channels. Weigh the complete first configuration at the declared load. E01 sets a 2,150 kg limit and a subsequent 1,850 kg objective. The R06 starting estimate is 2,327.05 kg. Reconcile removed gas equipment and all replacement mount hardware.

Parallel research delivery

Prepare independent supply, controllability and contact verification on a restrained rig using RWD geometry. Its mass, inertia and supports must represent the declared model or have measured corrections. The first vehicle carries no flight vessels. Transfer rig results only after recalculation with the actual vehicle mass, inertia and installed equipment.

Release decisions

G0 establishes two configurations. G1 produces R06.1 candidates for body, mount and running-gear checks and maps for braking, downforce and electrical power. G2 reviews the ground budget and B09 separately. B09, B10 and C11 must close before research-system integration. A separate G4-Ground release assesses faults applicable to this AWD.

The operator score is at least 9 successful cycles in the first 10, counting aborted attempts, and ready to restart within 20 min. D08 also requires five successive 0–100 mph accelerations with braking and peak-power loss ≤5%.

Architecture and scope

Option 2 RWD sprint demonstrator

Deliver a lightweight rear-drive car for three closed-track events: 0–60 mph, 0–100 mph and 402.336 m. The expert concept couples wheel traction to a horizontal gas impulse of up to 1.0 s. Vertical manoeuvres are outside the first delivery.

Work sequence and acceptance

1. Freeze RWD mass, loads, scoring discipline and comparator. Establish a measurable budget for longitudinal force, electrical power, front-axle reaction and traction. Compare specific power with actual tyres, drive and surface. The R06 RWD mass estimate is 2,227.58 kg.

2. Before enabling gas assist, qualify its mounts, physical route, failures and stopping behaviour for longitudinal use. Reassess C11/C12 and launch loads. The B09 landing assessment has a different scope. Specify a separate test for the sprint system’s envelope, force impulse, stability and brakes.

3. Accept electric-drive and braking measurements first, then review integrated uncrewed track operation. Log both start conventions and terminal speed. If comparable Rocket telemetry is unavailable, report absolute IMPULSE series results under A09.

V2 requires its own estimate and schedule before procurement. Stop if the onboard system lacks release, steered-axle load fails D03 or braking fails D05. An electric configuration may proceed under a newly issued configuration record.

Architecture and scope

Option 3 Electric track car

Remove flight functionality and all high-pressure gas components from the running vehicle specification. Use ground AWD as the planning baseline inherited from V1. The owner selects the V3 driveline at G0 since the experts did not prescribe one for this option. Preserve the exterior, axle datums and door apertures.

Delivery and design changes

Balance removed vessels, plumbing and valves against new brackets, reinforcement and guards. Verify the ≥150 kg saving hypothesis against the selected original branch with matched fluids, equipment and loading. Independently close suspension-rail and plenum clashes, load paths and clearances. The released 31.29 L refers to the R06 nose package’s internal volume.

Acceptance programme

G0 fixes the circuit, operator and conditions. G1 verifies geometry, weight, downforce map, tyres, friction brakes and HV protection. G2 closes electrical and thermal budgets including a fan-section failure. G4-Ground evaluates sustained 2.2 g_0 on a 50 m radius, lane change, braking corridor and lap time. Set the lap-time threshold for the agreed course before scored running. G5 verifies repeatability under A06/D08.

Tesla Performance is the ground-class reference. A lap comparison requires an agreed protocol and a measured reference result. The requirements owner signs exclusions for flight-only B/C items. C11/C12 and applicable ground safety requirements remain mandatory.

Architecture and scope

R06 baseline and comparison rule

Quantity	AWD	RWD
Modelled mass / weight	2,327.05 kg / 22.82 kN	2,227.58 kg / 21.85 kN
Stock thrust, PR, Cd = 0.95	21.13 kN	21.13 kN
Stock airborne time / distance	0 s / 0 m	0 s / 0 m
Residual pressure allowed by inventory / required by flow[1]	≤5.20 / ≥13.46 MPa	≤5.88 / ≥12.68 MPa
Imposed descent from 5 m, CG speed	7.02 m/s	6.88 m/s
Translational energy at 276 mph	17.71 MJ	16.96 MJ

[1] Pooled inventory, ideal Cd = 1, $F/\dot{m}$ = 690 m/s and thrust twice instantaneous weight. In the prescribed scenario the CG rises 5 m and travels 25 m in 2.646 s, entering at 34.01 km/h horizontally and touching down at 2.5 m/s vertically. New configurations and test evidence are required to revisit HOLD.

Meaning of the +20% objective

Use rule B for an identical speed increment: $t_i + U_i \le (t_r - U_r) / 1.20$. The Rocket claim of <0.59 s gives a boundary of 0.4917 s. Rule A yields a 0.472 s internal stretch target. The reported 0.81 s belongs to the demonstration run. A comparative score requires a measurement record for the reference. Metrology must justify the coverage probability and uncertainty budget for k = 2.

At 0.472 s, translational energy alone demands 1,773.49 kW on average for AWD. Even at 1,700 kg the lower bound is about 1,295.6 kW. R11B allocated 880.5 kW at the shafts with suction on. Account separately for losses between the DC bus, inverter inputs and wheels.

Architecture and scope

Implementation sequence

November–December 2026 · freeze the delivery scope

The programme lead prepares two V1 configuration records. Metrology defines timing origin, units, uncertainty and initial conditions. The chief engineer signs the 257 exterior bodies and datums for each branch. The site operator and regulatory lead establish the scope of each activity.

December–January · clear design blockers

Branch AWD and RWD R06.1 candidates from R06 on common datums. Record mass and CG before and after changes, interface owners and affected checks. Run rear mounts C11, swept envelopes C12, routing B10 on gas-equipped configurations and HV safety E10 in parallel. Independent reviewers check hashes, reopening, pair-level results and outstanding issues.

January–March · accept measured subsystem performance

Close maps for downforce D04, braking D05, power E03, thermal limits E11 and gas supply B01. Feed records from one revision into the agreed models. A mass or mount change reopens dynamics, loads, clearance and braking checks. At G2 the chair signs separate ground-vehicle and research decisions.

March–September · release, repeatability and issue

For the ground branch, prepare the running prototype, weight record, abort and egress evidence, then graded track runs. The research branch first correlates its model on the restrained rig. A change from a component test to occupied use, free motion or an expanded envelope requires a separate release record. G5 uses a frozen configuration and a log of all attempts and interventions.

Architecture and scope

Decisions to close before release

C11 · identify the component before relocation

The expert text refers to a steering rack. The R04 report and 18-part R03–R06 comparison identify suspension rails SuspensionRail004/006. Confirm the CAD name, cavity envelope and placement at each location. Each upper pin occupies 34,023.45 mm³ of the T101/T102 keep-out, each lower pin overlaps 5,329.52 mm³ of a rail, and two forward lower pins each overlap 2,956.32 mm³ of a plenum take-off. The chief engineer selects the modification after this identification.

B01/B04/B09 · test domain and margins

The 5–35 MPa map does not cover the model's 49.05 MPa initial storage point or the proposed 70 MPa case. At G1 specify the pressure reference location and evidence needed to extend the domain. Before G2 define each margin denominator and uncertainty. For B09 demonstrate simultaneous ≥15% inventory and flow margins. B04 separately requires 20% above braking consumption plus the attitude-control budget under a fault. The source provides no basis for adding these percentages.

E10 · safe discharge time

The narrative specifies under 5 s for both active and passive discharge. The E10 card allows ≤5 s active and ≤120 s passive to below 60 V. Before energisation, the HV lead and independent reviewer must sign limits for each path, including failure cases. Retain both source statements in the decision log.

Architecture and scope

Acceptance conditions and authority

Timing and evidence

One protocol must report both true-start timing and timing after 304.8 mm of travel. D01 defines motion detection and independent measurement channels. SAE J1349 and J2951 cited in the attachment concern engine power and drive-cycle conformity. Metrology should review SAE J1491 for the timing origin and agree applicability before testing.

Envelopes, contact and brakes

C12 retains −210 to +40 mm travel, ±18° steering and 1,640/1,648 mm front track. If 6 mm nominal and 3 mm loaded clearance cannot be achieved, return the geometry for revision. Mechanical travel or steering limits require an owner-approved change. C06 uses a 1 s dwell to classify stable contact. A07 requires 5 s on all four wheels to complete the cycle. Allocate vehicle energy to individual brakes for the dyno. Verify the 3.5 m braking corridor on the vehicle and the separate 4 m landing corridor under A07.

G0 and the two G4 releases

A05/A03 are scheduled after 7 December. Before declaring G0 closed, record conditions due on 10 and 15 December or move formal closure. The general G4 wording refers to G1–G3, while the ground route references ground G1/G2. The chair and technical director must identify any G3 evidence applicable to ground release. G4-Hop requires G3 and an external F01 decision. Site jurisdiction and authority require confirmation. The attached minutes are a proposal with no verifiable signatures.

V1 implementation plan

Programme gates G0 / G1

G0 · 7 Dec 2026 · cap of RUB 3.50m for documentation, metrology and legal review.

Adopt V1 as the proposed baseline. Deliver an AWD ground vehicle without onboard pressure vessels and keep a separate RWD rig. Use method B for the 20% acceleration gain and retain A as an internal target. Exclude active suction on ramps with R ≤20 m.

Present mission A01, methodology A02/D01, applicability ruling B05/F01, estimate F06 and exterior baseline. A05 and A03 are due later, on 10 and 15 December. Record a conditional decision on 7 December and dates for closure, or move G0 closure.

Programme manager and chief metrologist. Chair and technical director jointly sign subject to the independent safety lead’s position. Hold affected scope if branches are not separated or site clearance is missing.

G1 · 25 Jan 2027 · RUB 28.00m ±15% after tender, range RUB 23.80–32.20m.

Repackage rear mounts and routing in R06.1. Commission isolated tyre, gas, HV/drivetrain, suction fan and friction brake tests. Keep powered test objects unoccupied.

Submit C11/C12, B10, E10, B01 map, D04, D05 and E03/E11. Require zero keep-out interference, ≥3 mm loaded clearance and ≥15 mm HP-to-LV clearance. Verify ≥500 Ω/V isolation and active discharge below 60 V within 5 s. Agree the passive discharge limit under E10 before energising. Record equivalent braking energy and axle allocation for AWD and RWD.

Chief engineer and B–E leads. Open clashes block progression of the affected configuration. Any F04 trigger stops the rig concerned. Keep the full vehicle de-energised and unpressurised until applicable B10, C11, C12 and E10 acceptance.

V1 implementation plan

Programme gates G2 / G3

G2 · 1 Mar 2027 · provisional RUB 19.50m, funding decision after G1. B09 evidence is due 25 Feb 2027.

Prepare the coupled gas and energy model and HIL controls. Integrate physical systems only after G1 acceptance. Test single failures and shared consumers.

One measured B09 duty cycle must show a non-empty pressure window with simultaneous inventory and flow margins ≥15%, including B04. Present B06/E04 protection logs. The ground branch needs its own electrical power, suction and brake decision.

Gas-system lead and functional safety lead. A negative B09 decision closes free flight under F08. In V1, a positive B09 result also requires B10 and C11 before progression. Free flight remains on HOLD.

G3 · 15 Apr 2027 · cost to be set at G2.

After G1 and G2 acceptance, correlate 6DOF and tyre contact models with measurements on a tethered mass-representative RWD rig. Planned steps reach 0.3 m and 1.0 m. This applies to V1 research.

C03, C06, C08–C10. At |CG vertical speed| ≤2.5 m/s, first contact point normal speed ≤3.2 m/s. Remaining travel ≥15 mm. Contact-time discrepancy ≤15 ms and force discrepancy ≤10%. Demonstrate control retention under a single fault.

Dynamics/contact lead and independent test director. Secondary liftoff, bottoming or control-moment margin <1.3 retain HOLD.

V1 implementation plan

Programme gates G4 / G5

G4 · G4-Ground 1 Jun 2027 · G4-Hop 15 Jul 2027. Budgets to be set after G2/G3.

Separate G4-Ground and G4-Hop. Authorise only proven AWD track speed steps within tyre, brake and suction limits. G4-Hop is a separate uncrewed release after G3.

Provide a readiness review, applicable P0 closures, F01/B05, verified abort and one D01 or A07 cycle. The attachment gives both G1–G3 generally and ground G1/G2 for Ground. The committee must record the applicability of G3 to Ground. Hop requires G1/G2/G3 and external authorisation.

Test director and site safety lead. Stop on F04, departure from the 3.5 m braking corridor or C02 limit exceedance. A driver requires separate written release.

G5 · 1 Sep 2027 · series budget for approval at G4.

After the corresponding G4 release, run A06/D08 on the frozen F07/E12 configuration. Limit readiness and competitive claims to the measured duty cycle.

≥10 attempts, ≥90% success and readiness recovery ≤20 min. At G0 clarify how the ≤15 min allowance applies to 15–80% charging and thermal recovery, including workload, starting SOC and temperature. Supply teardown inspection and the reproducibility archive F07.

Chief engineer, operator and chief metrologist. Stop for >5% thrust/power degradation, permanent deformation or an unrecorded configuration change.

Provisional V1 estimates

Cost estimate and dated outputs

Indicative funding through G2 is RUB 51.0m: G0 up to 3.5m, G1 budgeted at 28.0m (±15%) and G2 provisionally at 19.5m. G3–G5 remain unpriced. V2 and V3 require separate estimates and schedules.

ID / date	Planned evidence	RUB m
F02 / 2026-11-25	Draft chair's stage record · CHAIR_RU.md. Included in G0 management with no separate price.	in G0
A01 / 2026-12-07	Agree separated missions with operator · MISSION_CARD_R02_G0.pdf	0.50
A02 / 2026-12-07	20% improvement and uncertainty protocol · TARGETS_METROLOGY_R02.json	0.45
A05 / 2026-12-10	Protected body and datum manifest · DATUMS_FROZEN_R06_1.json	0.40
A03 / 2026-12-15	Benchmark and timing comparability · BENCHMARK_PROTOCOL_R02.md	0.30
E10 / 2026-12-28	HV protection rig, procedure and acceptance record · HV_SAFETY_CLEARANCE_G1.pdf	1.60
B10 / 2027-01-10	Routing, brackets, clearance and mock-up · ROUTING_CLEARANCE_R06_1.json	1.10
C11 / 2027-01-15	Rear mounts, load path and FEA · REAR_MOUNT_ZERO_CLASH_R06_1.json	3.40
E03 / 2027-01-18	Drivetrain load rig and synchronised curves · HV_POWERTRAIN_SYNC_G1.json	3.20
B01 / 2027-01-20	Rig and measured gas-module map · GAS_RIG_CD_MAP_G1.parquet	6.80
C12 / 2027-01-25	Suspension sweep and tyre test · SWEEP_ENVELOPES_R06_1.step	1.90
D05 / 2027-01-25	Brake specimens and inertia dynamometer · BRAKE_DYNO_18MJ_G1.pdf	4.50
B09 / 2027-02-25	Joint inventory and flow verification · PRESSURE_WINDOW_CLOSURE_G2.pdf	4.20

The 12 priced records total RUB 28.35m: 1.65m at G0, 22.50m at G1 and 4.20m at G2. These are components of the stage estimates. F02 is covered by G0 management. Finance must define the base of the 20% repeat-test allowance and confirm whether it is already included.

Verification matrix

Targets T01–T09

A–F IDs link each target to a requirement and owner. Historical targets and manufacturer claims retain their original scope.

ID	Applicability, threshold and evidence
T01	V2 · Rocket 0–60 mph. Tesla claims <0.59 s. Rule B boundary 0.49167 s, internal A 0.472 s. Demo run announced at 0.81 s. Matched measurements and U95 required. A02/A03/D01.
T02	V1/V2/V3 · Thrust 0–60 mph. Tesla <0.9 s gives a B boundary of 0.750 s. Top Gear's 0.85 s estimate would give 0.708 s. V3 compares with Performance <1.6 s, B boundary 1.333 s. A02/A03/D01.
T03	V1/V2/V3 · 2021 SpaceX package. Owners' club account of a museum plaque: 1.10 s to 60 mph. Historical B reference ≈0.917 s. Current Rocket needs its own record. A03/F05.
T04	V1/V2/V3 · Base 2017 Roadster. Archived Tesla card: 1.90 s to 60 mph. Historical B reference ≈1.583 s. Match the start definition and vehicle version. A03/D01.
T05	V1/V2/V3 · 0–100 mph. Tesla's historical 4.20 s for the base 2017 car gives 3.50 s under B. No comparable Rocket trace. D08 also requires an IMPULSE repeat series. A02/D01.
T06	V2 · Quarter mile (402.336 m). Tesla 2017 card: 8.8 s, event: 8.9 s. Internal −20% time targets: 7.04/7.12 s. This is a fixed distance. Agree scoring metric and terminal speed. A02/D01.
T07	V1/V2/V3 · Tesla Rocket >230 mph. Scaled bound >276 mph (>444 km/h). Tyres, brakes and stability constrain 25 mph release steps. An actual +20% claim requires a measured reference. D02/D05/D07.
T08	V1/V3, V2 by mission · Tesla family >300 mi, cycle unspecified. Bound >360 mi (≈579 km). Top Gear 310–320 mi and historical 620 mi are distinct references. Separate WLTP and 15%-downforce track cycle. A04/E05.
T09	V1/V2/V3 · Top Gear: 500 kW and <15 min, 15–80% SOC. Internal −20% time reference <12 min. Own test starts at 30 °C on ≥350 kW, cell limit 52 °C. Match capacity, SOC window and charge curves. E09/A06.

Verification matrix

Targets T10–T18

A–F IDs link each target to a requirement and owner. Historical targets and manufacturer claims retain their original scope.

ID	Applicability, threshold and evidence
T10	V1/V2/V3 · Top Gear: Performance 1 MW, conditional reference 1.2 MW. Tesla 2017: 10,000 N·m at the wheels. Match measurement boundary, speed and duration. The R11B 1 MW figure is at the DC bus. E03.
T11	V1/V2/V3 · Tesla event: up to twice vehicle weight in suction in a specific mode. R11B 48.50 kN is modelled. Compare extra force/weight at matched clearance and speed using measured maps, including a fault. D04.
T12	V1/V3, V2 by mission · Tesla claims >2 g laterally. +20% on that bound gives >2.4 g. Own target ≥2.2 g on a 50 m-radius circle. Specify duration, tyres and surface. D02/D06/A09.
T13	V1 rig · The Rocket event documents a demonstration. Comparable measured height, distance, time and first-contact speed remain open. V2 defers flight, V3 excludes it. A03/C01/F05.
T14	V1 rig · lift42 is the DEV42 replica case in the DEV44 viewer, targeting 2.5 m / 1.8 s. Transfer the phase, flow and contact checks. Determine absolute results from IMPULSE data. C01/C07/C09.
T15	V1 rig · 5 m CG rise / 25 m / |CG vz|≤2.5 m/s. First-contact normal speed ≤3.2 m/s. Stock model 0 s / 0 m. Prescribed case 2.646 s with 34.01 km/h entry. Free flight on HOLD. B09/C01/C05.
T16	V1/V2/V3 · Own score: ≥90% successful cycles across ≥10 attempts, turnaround ≤20 min. Separate five 0–100 mph and braking cycles, power loss ≤5%. No comparable Rocket series. A06/D05/D08.
T17	V1/V2/V3 · Tesla event cited two tanks, 600 L total, ≈250 kg of air and ten outlets. These describe an architecture. Use each IMPULSE branch’s own loaded mass, usable gas and interfaces. A04/B03/E01.
T18	V1/V2/V3 · Tesla’s Rocket page restricts public-road use. For IMPULSE obtain separate decisions for rigs, ground track, occupied tests and, under V1, free uncrewed motion. A08/F01/F02.

Annex / requirements and acceptance

Product and benchmark A01–A03

V1 · G0 · S01 lines 19–23, 29, 67–71, 122–133

A01 Operator mission

The first track-operator delivery is an electric AWD demonstrator with active downforce and no onboard high-pressure vessels. Short-hop research uses a separate uncrewed RWD-geometry rig. Phase two requires B09, B10 and C11 closure and a separate committee decision.

Acceptance. Obtain customer and programme signatures on MISSION_CARD_R02_G0.pdf, identifying both configurations, operating limits and evidence. V2 or V3 requires a revised mission and budget.

Owner. Programme lead and customer

V1/V2/V3 · G0 · S01 lines 29–35, 135–146

A02 The +20% rule

For a fixed change in speed, apply rule B: tI + U95,I ≤ (tref − U95,ref)/1.20. Use k=2 after checking coverage in the uncertainty budget. At 0.59 s the B boundary is 0.49167 s (rounded 0.492), and internal target A is 0.472 s. Use an absolute target when comparable reference measurements are missing.

Acceptance. Issue TARGETS_METROLOGY_R02.json for T01–T18. For each metric state improvement direction, physical reference, uncertainty, operating conditions and decision rule. Compare unrounded values.

Owner. Chief metrologist and customer

V1/V2/V3 · G0 · S01 lines 37, 69, 148–159

A03 Acceleration baseline

Keep the Rocket claim of <0.59 s separate from the announced 0.81 s prototype run. Obtain reference telemetry, configuration and start definition for a comparative verdict. Both figures remain benchmarks until then.

Acceptance. Record source, tyres, load, surface, initial state and both D01 timings (from rest and after 304.8 mm) in BENCHMARK_PROTOCOL_R02.md and F05. Apply A09 when reference data are insufficient.

Owner. Reference register owner and independent laboratory

Annex / requirements and acceptance

Product and benchmark A04–A06

V1/V2/V3 · G0 · S01 lines 47, 67–68

A04 Test configurations

Maintain a passport for each physical article. Under V1, track the gas-free AWD and prospective gas-module RWD separately. Between sprint and range tests allow only a tyre-set and downforce-mode change within 30 min, with bodywork assembled.

Acceptance. Record before/after states, mass, tyres, mode, operator and changeover time. Attribute every reported result to its specific test article.

Owner. Configuration owner and track operator

V1/V2/V3 · G0 · S01 lines 37, 68, 161–172

A05 Protected exterior

Preserve the native geometry of 257 exterior bodies per vehicle branch and the wheel-axis, door-opening and safety-cell mounting datums. Archive the reference SHA-256 values. Limit absolute normal deviation of assembled Class A surfaces at check points to 0.50 mm. The unbodied V1 rig has its own replicated-interface list.

Acceptance. Use DATUMS_FROZEN_R06_1.json to distinguish identical native body geometry from measured agreement after reopening CAD/STEP AP242 on shared datums. Record signed deviation, maximum and location.

Owner. Body chief designer and independent CAD reviewer

V1/V2/V3 · G5 · S01 lines 47, 107–111, 302

A06 Series readiness

Achieve ≥90% successful complete cycles in ≥10 consecutive attempts and ≤20 min from safe stop to readiness for the next start. Exactly ten attempts require at least nine successes.

Acceptance. Agree success, failure and timing events before the series. Record every attempt, abort, preparation task and duration under F07. Assess the five D08 cycles separately.

Owner. Future operator and chief metrologist

Annex / requirements and acceptance

Product and benchmark A07–A09

V1 · G4-Hop · S01 lines 39, 47, 49, 99–103

A07 Cycle completion

For a conditional second phase, time the full cycle from pre-start checks at zero speed to rest within a 4.0 m-wide corridor. Require stable four-wheel support for ≥5.0 s at rest, closed isolation valves and confirmation of the safe low-pressure state. Distinguish the 34.01 km/h entry into the airborne phase from the start of the whole cycle.

Acceptance. Return a synchronised record of start, ground acceleration, liftoff, first contact, C06 stable-contact event, full stop and final state. V2 phase one is ground-only and V3 excludes flight.

Owner. Dynamics and test lead

V1/V2/V3 · G0–G5 · S01 lines 41, 54–113

A08 Decision authority

The chair and technical director sign gate transitions, subject to clearance by the independent safety lead, who may stop work immediately. Define a separate release scope per branch. An occupied vehicle requires a separate written release.

Acceptance. Maintain a signed gate record with scope, date, dissent and restart authority. Submit the supplied draft record for signatures.

Owner. Chair, technical director and independent safety lead

V1/V2/V3 · G0/G5 · S01 lines 37, 47, 105–111

A09 Competitive claim

Make claims for a named vehicle class, configuration and test cycle. Until comparable measured Rocket data exist, report absolute performance in IMPULSE’s repeatable track-cycle category.

Acceptance. Issue a claim record with the A06/D08 series evidence, uncertainty and admissible comparisons. Identify own results, manufacturer statements and measured references separately.

Owner. Customer, operator and metrologist

Annex / requirements and acceptance

Gas system B01–B03

V1/V2 · G1 · S01 lines 38, 175–185

B01 Gas-system map

Map four concurrent consumers on the V1 RWD rig over 5–35 MPa. Record flow, force, pressure, stagnation temperature, effective velocity F/ṁ, Cd(p,T) and delay. Specify a separate horizontal profile for V2.

Acceptance. At least 5 repeats, sampling ≥2 kHz and force error within ±1.5%. Supply calibrations and GAS_RIG_CD_MAP_G1.parquet. Review the unit if Cd <0.90 or delay >25 ms. Qualify any pressure range beyond the map separately.

Owner. Gas dynamics lead and independent metrologist.

V1/V2 · G2 · S01 lines 38, 48, 83–86

B02 Available flow

Establish a 95% lower bound on available thrust and flow by phase, including cooling and concurrent demand. At F/ṁ=600 m/s the prescribed R06 braking-end demands are 73.15 kg/s AWD and 70.03 kg/s RWD. V2 requires its own sprint demand.

Acceptance. Deliver synchronised envelopes and scatter; flag each shortfall against demand at the same phase. The braking-end figures apply at that profile point. Agree the confidence procedure before testing.

Owner. Gas dynamics and metrology.

V1 · G1 · S01 lines 38, 48, 77

B03 Nose reserve

Select a V1 nose-reserve function: independent attitude-control inventory or connection to a common supply. R06's 31.29 L internal volume provides 2.80 kg usable above the modelled 25 MPa floor against a landing demand of order 40 kg.

Acceptance. Compare at matched mission and mass. Return schematics, phase-specific pressure, mass and flow budgets, failure consequences and the selection rationale. Account for the capped R06 outlets.

Owner. Gas-system architect and dynamics lead.

Annex / requirements and acceptance

Gas system B04–B06

V1 · G2 · S01 lines 48, 83–87

B04 Reserve under failure

Before braking, retain ≥120% of nominal landing gas mass plus an independent attitude-control budget for loss of one paired valve. Account for end-of-manoeuvre delivery.

Acceptance. Return the inventory at brake entry and time histories to touchdown under nominal and single-fault conditions. Agree denominators for B04's 20% and B09's 15% before testing to prevent double counting.

Owner. Gas dynamics, controls and independent reviewer.

V1/V2 · G0 · S01 lines 41, 48, 69–71, 101, 299

B05 Pressure-vessel records

Determine vessel classification, inspection authority, records and rules for filling, storage and transport at the chosen site. Substantiate a design life of at least 500 rapid discharge cycles with temperature monitoring.

Acceptance. Obtain an accredited specialist's applicability assessment for TR CU 032/2013, ISO 11119-3, ASME BPVC VIII-3 or other governing provisions. State edition, equipment, exclusions, qualification plan and rejection criteria. The 500-cycle value is a project requirement.

Owner. Conformity assessment body and site operator.

V1/V2 · G2 · S01 lines 41, 48, 52, 85–86

B06 Fault detection

Detect oxygen depletion in enclosed volumes, leaks, valve icing and sticking. Valve position monitoring shall detect sticking within 10 ms. The proposed icing indication is a seat temperature below −40 °C.

Acceptance. Record injected faults, detection times and time to safe state. Reconcile −40 °C with the seal's allowable limit. Link access lockout below 19.5% O_2 to F03 and protective actions to F04.

Owner. Gas-system diagnostics and independent functional safety lead.

Annex / requirements and acceptance

Gas system B07–B10

V1/V2 · G2 · S01 lines 47–48, 85, 109–110

B07 Recharge energy

For each gas cycle measure electrical energy drawn from the grid for gas preparation, gas used and thermal settling after filling. Time turnaround from a safe stop to the same authorised pre-start state.

Acceptance. Supply kWh/cycle, gas mass, thermal history, time and cost per accepted cycle. Include unsuccessful attempts. Compare measured turnaround with A06 and G5 objectives.

Owner. Operations lead and metrology.

V1/V2 · G1 · S01 lines 48, 77–79, 111

B08 Mounts and life

Weigh the actual vessels and cradles. Verify retention for longitudinal and vertical accelerations of 20 g_0. Inspect composite overwrap after any impact outside the qualified envelope.

Acceptance. Provide the mass and mounting record, load cases stating separate or combined axes, before/after inspection results and return-to-service criteria. Assess permanent deformation and inspection access.

Owner. Mounting designer, vessel specialist and NDT inspector.

V1 · G2 · S01 lines 5, 19, 38, 52, 83–87, 188–198, 301

B09 Joint inventory and flow margins

Reject the stock architecture for the flight mission. R06 residual-pressure bounds conflict: AWD ≤5.20 and ≥13.46 MPa, RWD ≤5.88 and ≥12.68 MPa. Verify that an alternative has an overlapping window and simultaneous margins ≥15% in usable mass and delivery, including B04.

Acceptance. For the candidates in the response (type IV/70 MPa with two-stage regulation or a variable flow area), deliver PRESSURE_WINDOW_CLOSURE_G2.pdf and measured time series with uncertainty. Define margin units and denominators before testing. A failed G2 closes the flight branch under F08.

Owner. Gas dynamics lead and independent reviewer.

V1/V2 · G1 · S01 lines 7, 38, 75–79, 200–211, 300

B10 Routing continuity

Demonstrate a continuous collector-to-consumer path in each gas-equipped configuration. For R06.1 check all four outlets and ≥15.0 mm assured clearance between high-pressure lines and LV harnesses including tolerance, vibration and protection. Use the actual V2 consumer set.

Acceptance. Supply the assembly, ROUTING_CLEARANCE_R06_1.json and assembly procedure. Check fixed and moving neighbours, access, guards and the A05 exterior. Original R06 outlets are capped and the nearest checked clearance to LV_Trunk_L is 4.22 mm.

Owner. Packaging lead with gas and harness owners.

Annex / requirements and acceptance

Dynamics and contact C01–C04

V1 · G0 · S01 lines 3, 39, 47, 69

C01 Liftoff and reference points

Define liftoff as all four individual wheel normal reactions falling below 50 N simultaneously for at least 20 ms. Report CoM rise and clearance of the lowest point of the deformed tyre separately relative to the local ground plane.

Acceptance. Define start, liftoff and first contact, including sensor noise and synchronisation. Corroborate unloading with an independent optical clearance measurement. Measure airborne time and distance from the liftoff event.

Owner. Dynamics, instrumentation and independent metrologist.

V1 · G1 · S01 lines 49, 77, 103

C02 Mass properties and attitude

Determine the rig’s full inertia tensor and CoM at gas depletion states, including the 40 kg example. Proposed attitude envelope: roll ±3°, pitch ±4°, absolute monitored angular rates ≤15°/s.

Acceptance. Provide the mass record, tensor and longitudinal and vertical CoM shift. Before model acceptance set the yaw envelope, axes covered by 15°/s and the response to an exceedance.

Owner. Dynamics lead and mass-properties owner.

V1 · G3 · S01 lines 49, 91–95

C03 Control moment margin

Verify attitude-control torque margin with lift and attitude consumers sharing the supply. For 5% thrust asymmetry the available-to-disturbance torque ratio shall be ≥1.3 throughout the specified envelope.

Acceptance. Provide a six-DOF map by axis, phase and flow, including saturation, single faults and permitted operating bounds. State the rule for zero disturbance torque and document independent review.

Owner. Dynamics and controls leads.

V1 · G1 · S01 lines 39, 49, 77

C04 Time alignment

Synchronise wheel load sensors, laser altimeters, inertial unit and suspension-travel sensors using a common hardware PPS/IEEE 1588 PTP time base. Limit interchannel skew to 0.5 ms.

Acceptance. Supply common-event timing checks before and after each series, channel latencies, calibrations, missing samples and raw logs. An independent channel shall distinguish support, unloading and physical clearance.

Owner. Chief metrologist and instrumentation lead.

Annex / requirements and acceptance

Dynamics and contact C05–C08

V1 · G1 · S01 lines 39, 77, 91–95

C05 First contact

At first contact, limit absolute vertical CoM velocity to 2.5 m/s and the first tyre-point normal velocity to 3.2 m/s. Retain ≥15 mm to the hard stop. All four wheels shall not leave the ground again after touchdown.

Acceptance. Report first-contact order for all low parts, local normal, forces, speeds, travel and rebound. Body-first contact leaves the tyre-touchdown requirement open. Define acceptance for partial rebound and correlate under C09/C10.

Owner. Contact dynamics lead and suspension engineer.

V1 · G3 · S01 lines 47, 49, 93–95

C06 Sustained ground contact

Stable support requires each wheel to carry >15% of its own static load continuously for ≥1 s with decaying hub vertical velocity. A07 mission completion requires ≥5 s on four supports. Limit lateral drift at the stop to 0.5 m in a 4 m landing corridor.

Acceptance. Log first contact, establishment of stable support and standstill as separate events. Supply individual loads, hub velocities and ground track. Confirm the gas system’s final safe state for A07.

Owner. Chassis, contact dynamics and test leads.

V1 · G0 · S01 lines 19–21, 47, 49, 83–84, 91–102

C07 Verification stages

Define this progression for the uncrewed rig: restrained static unloading, a 0.3 m vertical step with no horizontal motion, a 1 m low-speed step, then a separate decision on 5 m / 25 m. Exclude aerial rotation from R06.

Acceptance. Provide a stage sheet with preceding approvals, initial horizontal speed, restraint geometry and stop criteria. The full profile requires G3, a separate G4-Hop decision and external clearance. R06 remains on HOLD.

Owner. Test director, independent reviewer and committee chair.

V1 · G3 · S01 lines 49, 83–84, 93–95

C08 Near-ground fault

Below 2.0 m, following a single sensor fault, prioritise levelling and vertical-rate damping. Verify the proposed voting architecture with three inertial channels.

Acceptance. Inject individual sensor faults and disagreement on HIL. Check detection, residual observability and control authority. Analyse common-cause faults and loss of a sole altitude reference. Report the resulting state and margins against C02/C03/C05.

Owner. Controls lead and independent functional safety lead.

Annex / requirements and acceptance

Dynamics and contact C09–C12

V1/V2/V3 · G3 · S01 lines 49, 91–95

C09 Tyre contact

Identify a nonlinear viscoelastic contact model by static compression and impact testing of a physical 650 × 210 mm tyre. Flight contact criteria apply to V1; ground variants supply data for their actual tyres.

Acceptance. Separate identification and validation datasets. For V1, first-contact timing error shall be ≤15 ms and normal-force discrepancy ≤10%. Define the force metric, denominator and near-zero treatment before testing.

Owner. Tyre engineer and contact dynamics lead.

V1 · G3 · S01 lines 49, 93–95

C10 Model convergence

Limit the trajectory and braking-event integration time step to 1.0 ms. Estimate numerical, parameter and instrument errors separately. The historical 50 mm height-grid increment is a spatial quantity.

Acceptance. Provide a time-step convergence study and comparison to the C09 independent series. Before data collection agree repeat count and confidence coverage, with allowable timing error ≤15 ms and force discrepancy ≤10%.

Owner. Modelling lead and independent metrologist.

V1/V2/V3 · G1 · S01 lines 7, 39, 75–79, 213–224, 300

C11 Rear mounts

Close the rear-arm load path into the subframe. Worst-case tolerances shall give zero interference between pins and keep-outs of installed vessels, suspension rails and plenum takeoffs. Yield factor ≥1.5 and ultimate factor ≥2.0 apply to E02 load cases.

Acceptance. Supply R06.1 assembly, REAR_MOUNT_ZERO_CLASH_R06_1.json and FEA. The primary report identifies tubular suspension rails SuspensionRail004/006. Verify these BReps and substantiate any proposed steering relocation separately. Check the structure in the cleared space on gas-free branches.

Owner. Chief chassis designer and independent structural analyst.

V1/V2/V3 · G1 · S01 lines 7, 39, 75–79, 226–237, 300

C12 Loaded clearance

At 1640 and 1648 mm front track verify full −210 to +40 mm suspension travel and ±18° front steering. Continuous nominal-envelope clearance shall be ≥6.0 mm and residual clearance ≥3.0 mm with tolerance, combined loading, deformation and tyre growth.

Acceptance. Supply SWEEP_ENVELOPES_R06_1.step and rig checks with the actual tyre, showing the pair and pose for each minimum. Redesign internal packaging if it fails. Restricting travel or steering requires a separately approved owner change.

Owner. Chassis integration engineer and independent CAD reviewer.

Annex / requirements and acceptance

Ground dynamics D01–D03

V1/V2/V3 · G0/G4-Ground · S01 lines 37, 40, 69, 152–158

D01 Timing

Synchronise RTK-GNSS/INS and external optical gates for sprints. Log at ≥1 kHz and report elapsed time both from first movement and after 304.8 mm of rollout. Specify endpoint speed, allowed error, native sensor rates and timing alignment.

Acceptance. Calibrate the independent channels and verify first-motion detection and latency. Attach raw traces for 0–60 mph, 0–100 mph and the quarter mile as applicable to the mission. Check applicability of the selected SAE J1491 edition.

Owner. Chief metrologist and test director

V1/V2/V3 · G1 · S01 lines 50, 75–79

D02 Tyres and load

Obtain Pacejka tyre coefficients, verified speed envelope and rated loads, allowing for vehicle weight, load transfer and the 48.50 kN modelled downforce benchmark.

Acceptance. Obtain the data sheet and force, temperature and growth maps. Compare them against maximum loads at each wheel and model validity. Restrict operation to the supported envelope.

Owner. Tyre engineer and supplier

V1/V2/V3 · G1/G4-Ground · S01 lines 50

D03 Steering authority

At longitudinal acceleration >1.8 g_0 retain total normal reaction at the front steered axle of ≥20% of current vehicle weight. Check both drivetrains and each approved mode.

Acceptance. Issue a torque-distribution map and four synchronised wheel reactions. Correlate the model to rig data and within the authorised track envelope.

Owner. Vehicle dynamics and traction-control lead

Annex / requirements and acceptance

Ground dynamics D04–D06

V1/V2/V3 · G1 · S01 lines 19, 40, 75–78, 301

D04 Downforce and section failure

Map downforce with a moving ground plane over 0.5–25.0 mm skirt gaps, roll up to 3° and one fan stopped. Agree residual rear load and yaw limits to preserve stability during the first 150 ms after a fault. The 48.50 kN figure is an R11B estimate.

Acceptance. Measure all four reactions, sectional pressures, electrical demand and transients. Derive allowable clearance and residual downforce. Approve the numerical stability limit before the series.

Owner. Aerodynamics lead and vehicle dynamics engineer

V1/V2/V3 · G1/G4-Ground · S01 lines 40, 78, 99–103, 239–250

D05 Brake duty

Three consecutive stops from the equivalent of 276 mph to zero at 100% SOC, with regeneration and downforce unavailable. R06 translational energy per stop is 17.71 MJ AWD or 16.96 MJ RWD. Require ≥1.05 g_0 mean deceleration, intact friction components and no fluid boiling. Track corridor width is 3.5 m.

Acceptance. Agree energy split and rig inertia for the selected vehicle mass. BRAKE_DYNO_18MJ_G1.pdf establishes heat capacity and torque. Verify tyre grip and vehicle deviation separately within the released ground envelope.

Owner. Brake lead and track safety lead

V1/V3 · G0/G4-Ground · S01 lines 50, 69

D06 Cornering performance

Track branch target: sustained ≥2.2 g_0 lateral acceleration on a steady 50 m-radius circle with active downforce. Evaluate the double lane change separately using agreed entry conditions and corridor. For V2, applicability depends on A01.

Acceptance. Record radius, steady-state duration, speed, lateral acceleration, tyres, surface and wheel reactions. The cited typical 1.2 g_0 is not a measured Tesla benchmark.

Owner. Vehicle dynamics engineer and track operator

Annex / requirements and acceptance

Ground dynamics D07–D09

V1/V2/V3 · G1/G4-Ground · S01 lines 50, 99–103

D07 Speed envelope

Verify longitudinal static stability in the low-drag mode at yaw angles up to ±8°. After brake and tyre acceptance, extend the approved speed in 25 mph steps to the verified limit. At fixed ρ and CdA, aerodynamic power increases 1.728-fold from 230 to 276 mph.

Acceptance. Submit wind-tunnel force and moment data, agreed stability margin, tyre record, D05 brake envelope and signed limit for each stage. Establish maximum vehicle speed using the combined evidence.

Owner. Aerodynamics lead and track test director

V1/V2/V3 · G4-Ground/G5 · S01 lines 50, 107–111, 302

D08 Repeated launches

Complete five consecutive 0–100 mph acceleration and hard-braking cycles without service-team intervention. Peak-power loss across the series shall be ≤5% from the agreed baseline.

Acceptance. Record each launch, stop, SOC, temperatures and power in one configuration. For V2 declare and track gas state. Compare the series log with A06, which requires ≥10 attempts.

Owner. Test director and future operator

V1/V2/V3 · G0/G1 · S01 lines 50, 67

D09 Ramp and skirt

Disable vacuum downforce on ramps with radius ≤20 m. Automatically lift the skirt and switch off the fans on entry. The historical 20 m case predicted 42.3 mm profile deviation against 6 mm shoe travel.

Acceptance. Reproduce the profile on a rig or validated model. Record entry detection, safe transition sequence, clearance and response to faults. Define the non-ramp envelope from D04.

Owner. Downforce and functional safety engineer

Annex / requirements and acceptance

Energy and structure E01–E03

V1/V2/V3 · G1/G4-Ground · S01 lines 3, 40, 302

E01 Mass and CG

Perform a four-corner weighing and determine CG height by tilt. V1 first ground AWD mass limit is 2150 kg, with 1850 kg as a subsequent target. R06 estimates of 2327.050 kg AWD and 2227.575 kg RWD are the change-accounting baseline. V2/V3 require their own mass roll-ups.

Acceptance. Supply calibration, load per wheel, charge state, payload, temperatures and uncertainty. List gross removals and additions for each change. Confirm the completed configuration on scales.

Owner. Mass properties and packaging lead

V1/V2/V3 · G1/G3 · S01 lines 39, 94, 110–111

E02 Structural load path

Verify load transfer from supports into frame and safety cell. For the landing rig include asymmetric contact on one front and one rear wheel at n_z=3.5. For a gas-equipped branch cover failure of one vessel mount. Require ≥1.5 against yield and ≥2.0 against ultimate failure. Specify ground-vehicle road and incident loads separately.

Acceptance. Submit loads, boundary conditions, material properties, convergence checks and independent review, followed by specimen-test evidence. Inspect for permanent deformation after the G5 series.

Owner. Structures analyst and independent reviewer

V1/V2/V3 · G1 · S01 lines 11–13, 40, 252–263, 301

E03 Power budget

Prepare a synchronised 20 s budget across battery, DC bus, fans, pumps, inverters and shafts. At ≤1000 kW DC with 43.30 kW for fans and 12.0 kW for pumps, traction inverter input is capped at 944.7 kW before other loads. Submit a new power baseline for a battery change.

Acceptance. Provide voltage, current, efficiency, torque limits, SOC and temperatures in HV_POWERTRAIN_SYNC_G1.json. Separate shaft power (historical 880.5 kW), DC power and 1773.49 kW of translational kinetic power for AWD over 0.472 s.

Owner. HV powertrain lead

Annex / requirements and acceptance

Energy and structure E04–E06

V1/V2/V3 · G1/G2 · S01 lines 51, 83–86

E04 Backup power

Provide independent brake and steering power via 12/48 V branches using two physically separated $LiFePO_4$ batteries. After simultaneous loss of the main HV bus and DC/DC, sustain full control for ≥15 min and capacity for ≥10 full emergency brake events.

Acceptance. Submit a single-line diagram with common-cause failures, a measured energy budget and a rig fault-injection report covering steering, brakes and diagnostics. Record load sequence and remaining charge.

Owner. LV architecture and functional safety lead

V1/V2/V3 · G0/G5 · S01 lines 51, 69

E05 Range and energy

Record range separately under the applicable WLTP procedure and a defined track cycle with downforce active for 15% of time at 23±2 °C. Confirm range-goal applicability for the specialised sprinter under A01.

Acceptance. Specify cycle, phase/class, load and initial/final SOC. Separately measure charger energy including charging losses, usable battery energy and downforce consumption. Pursue road certification under the selected jurisdiction.

Owner. Energy test lead and metrologist

V1/V2/V3 · G1 · S01 lines 39, 51

E06 Tolerance stack

Create 3D tolerance stacks for suspension, skirt seals and battery mounts. Include manufacturing variation, loads and −10 to +85 °C at applicable under-bodywork zones.

Acceptance. Issue worst-case stacks, dimension maps and assembly checks at critical points. Compare with C12 nominal and loaded limits and verify selected materials and joints.

Owner. Lead designer, manufacturing engineer and dimensional engineer

Annex / requirements and acceptance

Energy and structure E07–E09

V1/V2/V3 · G1/G2 · S01 lines 51, 70, 78

E07 Procurement

V1 long-lead items comprise high-rate cells, SiC inverters, upright and arm forgings, friction brake parts and gas hardware for the separate rig. V3 excludes gas. Series body tooling follows the G2 decision. Spending requires an approved budget.

Acceptance. Issue a branch-specific BOM with specifications, lead times, quotations, accountable approver and order release conditions. Identify non-recoverable spending and F06 evidence covered.

Owner. Procurement lead and chief designer

V1/V2/V3 · G1/G4-Ground · S01 lines 51, 99–103, 302

E08 Egress and servicing

For a future occupied mode verify door egress in ≤10 s and rescue access to two external manual HV disconnects without special tools with deformed panels. A gas-equipped variant also requires accessible manual emergency venting.

Acceptance. Verify on a de-energised mock-up with representative panels and equipment. Return timed video and a rescue access map. Occupied running requires a separate written G4-Ground release.

Owner. Rescue systems, site safety and ergonomics leads

V1/V2/V3 · G0/G5 · S01 lines 51, 69, 109–110

E09 Fast charging

Test 15–80% charging from an initial battery temperature of 30 °C using a terminal rated ≥350 kW. Peak temperature during charging is 52 °C. Verify immediate track readiness and a pre-agreed degradation limit. At G5 define the ≤15 min charge and thermal-recovery interval within the ≤20 min turnaround.

Acceptance. Log terminal capability and actual acceptance curve, SOC, grid/battery energy, cell temperatures, capacity change and readiness time. Confirm whether both processes share the same 15 min window.

Owner. Battery and energy test lead

Annex / requirements and acceptance

Energy and structure E10–E13

V1/V2/V3 · G1 · S01 lines 40, 75–79, 265–276, 300

E10 HV protection

Agree limits with the independent electrical safety reviewer before energisation. Proposed values: isolation ≥500 Ω/V, HVIL ≤20 ms, precharge without contactor welding and DC decay below 60 V. Line 40 gives <5 s for both paths. The E10 card gives active ≤5 s and passive ≤120 s. Sign a separate unambiguous limit for each mode.

Acceptance. Issue HV_SAFETY_CLEARANCE_G1.pdf with waveforms, calibration and contact protection evidence. Keep operation above 60 V DC on hold pending resolution and clearance. These numerical limits are project proposals.

Owner. HV lead and independent electrical safety reviewer

V1/V2/V3 · G1/G5 · S01 lines 40, 109–111, 301

E11 Thermal duty

Define power derating before limits of 55 °C at cells, 150 °C at SiC junctions and 165 °C at windings. At 30 °C ambient verify inter-run cooldown in ≤15 min. E09 sets a separate 52 °C cell limit during charging.

Acceptance. Log synchronised temperature maps for E03, derating, recovery times and uncertainty in estimated junction temperature. Check compatibility with A06 and D08.

Owner. Thermal and powertrain lead

V1/V2/V3 · G1/G5 · S01 lines 37, 51, 109–111

E12 Single-revision release

Release one revision for the master, AWD/RWD variants, drawings/BOM and STEP AP242. Identify 257 protected exterior bodies, their SHA-256 values and A05 datums. Declare the separate contents of the unbodied rig.

Acceptance. An independent reviewer reopens the exact native CAD and STEP on a clean workstation and checks contents, recomputation and geometry. Link logs, first-open images and digests to F07.

Owner. Configuration manager and independent CAD reviewer

V1/V2/V3 · G0/G4-Ground · S01 lines 51, 69

E13 Lighting

For a closed track provide daytime running lights, conspicuous brake lamps and HV indication, plus gas status where applicable. Agree the competition class and applicable site/FIA requirements before acceptance. Road headlamp photometry is a separate homologation activity.

Acceptance. Verify the operating-state table, signal visibility, status recognition by staff and rescue crews, and loss-of-power behaviour. Record rule applicability. Approve a separate photometric protocol for any road version.

Owner. Lighting lead and approvals manager

Annex / requirements and acceptance

Release and governance F01–F04

V1/V2/V3 · G0 · S01 lines 41, 67–71, 97–103

F01 Applicable permits

Establish the jurisdiction, vehicle class and competent authority for cold assembly, LV tests, electric track runs, pressure equipment and free uncrewed motion. Confirm the experts' proposed approval route with each authority.

Acceptance. Operation-specific matrix naming the current clause, competent authority, site document and required external decision. Obtain separate decisions for the gas rig and G4-Hop.

Owner. Compliance lead, legal counsel and site owner.

V1/V2/V3 · G0/G1 · S01 lines 41, 65–87, 278–289

F02 Scope of release

The draft record scopes near-term work to documentation, CAD and isolated component rigs. V1's first AWD track car omits onboard pressure vessels. Vehicle pressurisation with an occupant is excluded.

Acceptance. Chair's release covering the rig, energy source, site and team. Verify chair and technical director signatures and the independent safety lead's position. Record a separate driver clearance.

Owner. Chair, technical director and independent safety lead.

V1/V2/V3 · G1/G4 · S01 lines 52, 97–103

F03 Site hazards

Define containment and exclusion zones for fragment, noise and run-off scenarios. Provide ventilation and access interlocking below 19.5% oxygen by volume in the gas cell. The attachment identifies exposure above 120 dBA as hazardous. Analysis determines the boundary.

Acceptance. Mode-specific site maps with fragment, braking and lateral run-off analysis, noise and oxygen measurements, and interlock checks. Assess each authorised speed step. The upper planning reference is 276 mph.

Owner. Independent safety lead, occupational hygienist and site engineer.

V1/V2/V3 · G1/G4 · S01 lines 41, 79, 99–103

F04 Abort and restart

Set rig/run abort conditions for inadequate logging rate, communications loss exceeding 50 ms, isolation failure, or pressure or valve temperature outside the approved envelope. Give the independent safety lead immediate stop authority.

Acceptance. Signal-limit-latency-safe-state matrix with independent logging, fault injection and terminal-state confirmation. Restart requires metrology and safety sign-off.

Owner. Test director, metrologist and independent safety lead.

Annex / requirements and acceptance

Release and governance F05–F08

V1/V2/V3 · G0 · S01 lines 37, 52, 67–71, 150–159

F05 Benchmark provenance

Maintain a versioned benchmark register covering trim, start event, rollout and uncertainty. A scored reference change requires primary instrumentation data at ≥100 Hz or an official homologation record with comparable timing conditions.

Acceptance. Versioned decisions for T01–T18. Until a comparable Rocket result is established, retain <0.59 s as a published claim and 0.81 s as the announced demonstration result. Record absolute IMPULSE results separately.

Owner. Chief metrologist and requirements owner.

V1/V2/V3 · G0 · S01 lines 41, 70, 78, 86, 94, 102, 110, 122–289

F06 Cost of verification

Cost each accepted evidence item. Distinguish fixtures, calibrated instrumentation, consumables, independent review and the proposed 20% allowance for retesting. Set the reserve base and identify inclusion in each stage total.

Acceptance. Supplier quotations, schedule and work register identifying stage, question ID, payment unit and independent signatory. Twelve of 13 detailed cards have prices. F02 is included in G0 management. Reconcile with the stage envelopes.

Owner. Programme manager, procurement, financial controller and metrologist.

V1/V2/V3 · G1/G5 · S01 lines 52, 105–111

F07 Configuration record

Freeze an as-built and as-tested record for each rig, vehicle and run. Bind CAD, VCU/FCU firmware, calibration, weigh-in, raw telemetry and processing versions with hashes.

Acceptance. Git/PLM record and independent reproduction of the reported metric from archived inputs. Every configuration change receives a revision and a list of affected acceptance checks.

Owner. Configuration manager and independent reviewer.

V1/V2/V3 · G2 · S01 lines 52, 83–87, 299–302

F08 Branch decision

If B09 fails, close the free-flight branch and submit resource reallocation to the ground EV programme. V2 horizontal assistance requires its own performance and safety decision. V3 excludes gas from the outset.

Acceptance. Record a continue, close or pivot decision, supported by simultaneous ≥15% inventory and flow margins including the B04 single failure, and an updated budget for the retained branch. V1 research exit also requires B10 and C11.

Owner. Chair, product owner, gas-system lead and independent reviewer.

Release control

Source records and decision form

The SOURCES folder contains the unaltered S01 expert response, 61 original questions, R06 results and geometry records. INDEX.html links all files and external publications. SOURCE_REGISTER.json contains the full checksums.

ID	Record
S01	Expert response, draft gate minutes and 13 structured replies
S02	Original 61 questions and 18 targets
S03	Stock AWD/RWD results and prescribed profiles
S04	Inventory and throughput pressure bounds
S05	Rear-mount comparison of six native assemblies
S06	Saved R06 geometry
S07	Historical R11B fan and drive power budget
S08	R04 rear-mount conflict report
S09	First opening of AWD R06
S10	First opening of RWD R06

Five agenda groups list 25 distinct IDs and the remaining groups list 36. All 61 are included. Only 13 have individual structured replies with due dates. Named verification reports in the requirements are planned outputs.

Owner decision at G0

Selected option _____ Authorised scope _____
Conditions and owners _____ Next gate _____
Chair _____ Technical director _____ Date _____
Independent safety lead’s conclusion _____